

Research Update

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Bottom Line

This research project tested redear sunfish's ability to reduce quagga mussel settlement through predation. Results showed that some fish will consume significant amounts of quagga mussels and some will not. Thus, redear sunfish and other predators may contribute to controlling mussels, but probably will not eradicate them in areas where the species co-occur.

Better, Faster, Cheaper

No single effective control measure can eliminate quagga mussels from infested water. However, resident redear sunfish may help to reduce, but not eradicate, quagga mussel in areas where they co-occur.

Principal Investigators

Cathy Karp
Fish Biologist
Fisheries and Wildlife
Resources Group
Technical Service Center
303-445-2226
ckarp@usbr.gov

Michael (Randy) Thomas
Biological Science Technician
Fisheries Group
Lower Colorado Region
702-293-8195
mrthomas@usbr.gov

Do Redear Sunfish Eat Quagga Mussels?

Experiments to evaluate predation of quagga mussels by redear sunfish

Problem

Zebra and quagga mussels in the United States have, and will continue to have, far-reaching negative economic and ecologic impacts. Mussel infestations clog water intake and conveyance structures and reduce water delivery, pumping, and hydropower capabilities. Additionally, quagga and zebra mussels filter substantial amounts of water, which negatively alters the food web of infested waters, in part by increasing water clarity. They also generate and potentially concentrate toxic waste that may pass up the food chain.

Possible mussel control measures include:

- Chlorination (and other chemicals)
- Oxygen deprivation
- Thermal, electrical, sonic, and pressure shock
- Desiccation
- Antifouling coatings
- Toxic bacteria
- Predation

Fish predation of invasive mussels may be one type of biological control that can contribute to reducing impacts of mussels in Reclamation facilities and water delivery structures.

Solution

This Reclamation Science and Technology Program research project evaluated whether fish predation on quagga mussels could help reduce mussel colonization in the lower Colorado River. Redear sunfish were selected for this research study because they are known molluscivores in Southeastern United States and, in some areas, occur with quagga mussels (e.g., Lake Havasu, Arizona/California). These redear sunfish were captured in upper Lake Havasu soon after the mussel invasion with quagga mussels in their stomachs. Bluegill were also included in the laboratory experiments because

they co-occur with redear sunfish and quagga mussels in some areas of the lower Colorado River.

This research study conducted laboratory and field enclosure replicated experiments to determine the ability of the fish to potentially reduce mussel infestations. Both sets of experiments confined quagga mussels with one or two redear sunfish (and bluegill in the laboratory).



A redear sunfish.

Applications and Results

The laboratory experiments were conducted in the Boulder City, Nevada, Fish Laboratory in Reclamation's Lower Colorado Region as both quagga mussels and redear sunfish were easily accessible. In the laboratory experiments, most fish consumed quagga mussels (89.3 percent of redear sunfish and 71.4 percent of bluegill). Consumed quagga mussels averaged 12.4 millimeters (mm) long (3.0 to 26.8 mm) and 7.4 mm high (2.2 to 16.2 mm). The larger fish ate larger mussels. Ingested mussels were mostly crushed and shell pieces regurgitated and defecated by the redear sunfish. Conversely, ingested mussels were not crushed by bluegill.

The field enclosure experiments were conducted in Lake Havasu (Arizona/California) as both redear sunfish and quagga mussels are well established there. In these experiments, the redear sunfish significantly reduced mussel density by as much as 25.3 percent, although this was not observed in all enclosures. Mussel density did not decline in enclosures without fish, and new mussel settlement was minimal. Redear sunfish that survived to study completion averaged 280.3 mm in length and weighed 488.2 grams (gm) (235 to 348 mm; 241 to 1,115 gm). Quagga mussels ranged in length from 4.4 to 24.6 mm.

Both laboratory and field experiments suggests that redear sunfish may help to reduce quagga mussel colonization in areas where the two species co-occur. While redear sunfish can significantly reduce mussel densities, they also consume other prey (e.g., redswamp crayfish), if available. As their response is variable, redear sunfish may help to control mussel infestations, but are not likely to eradicate quagga mussels where the two species co-occur. Thus, the findings do not suggest stocking redear sunfish to control quagga mussels.

“Invasive species, such as the quagga mussel, are an unplanned biological experiment gone awry. While redear sunfish generally consumed quagga mussels, their overall response varied. Therefore, they are not likely to eradicate quagga mussel infestations.”

Cathy Karp
Fish Biologist, Reclamation's
Technical Service Center



Aquaria used in laboratory experiments (note settled quagga mussels).



Fish/quagga mussel enclosure pen.



Enclosure pens deployed in a cove.

Future Plans

Quagga mussels are well established in the lower Colorado River and in some associated water delivery facilities and canals. This research suggested that fish control of mussels may contribute to reducing mussel colonies, but releasing redear sunfish to control quagga mussels is not recommended.

Research Office Contact

Joe Kubitschek, P.E.
Invasive Mussels
Research Coordinator
303-445-2148
jkubitschek@usbr.gov

Collaborators

Lower Colorado Region

More information

www.usbr.gov/research/projects/detail.cfm?id=9508